In Pursuit of Reuseable, Accurate, Electric Power System Models

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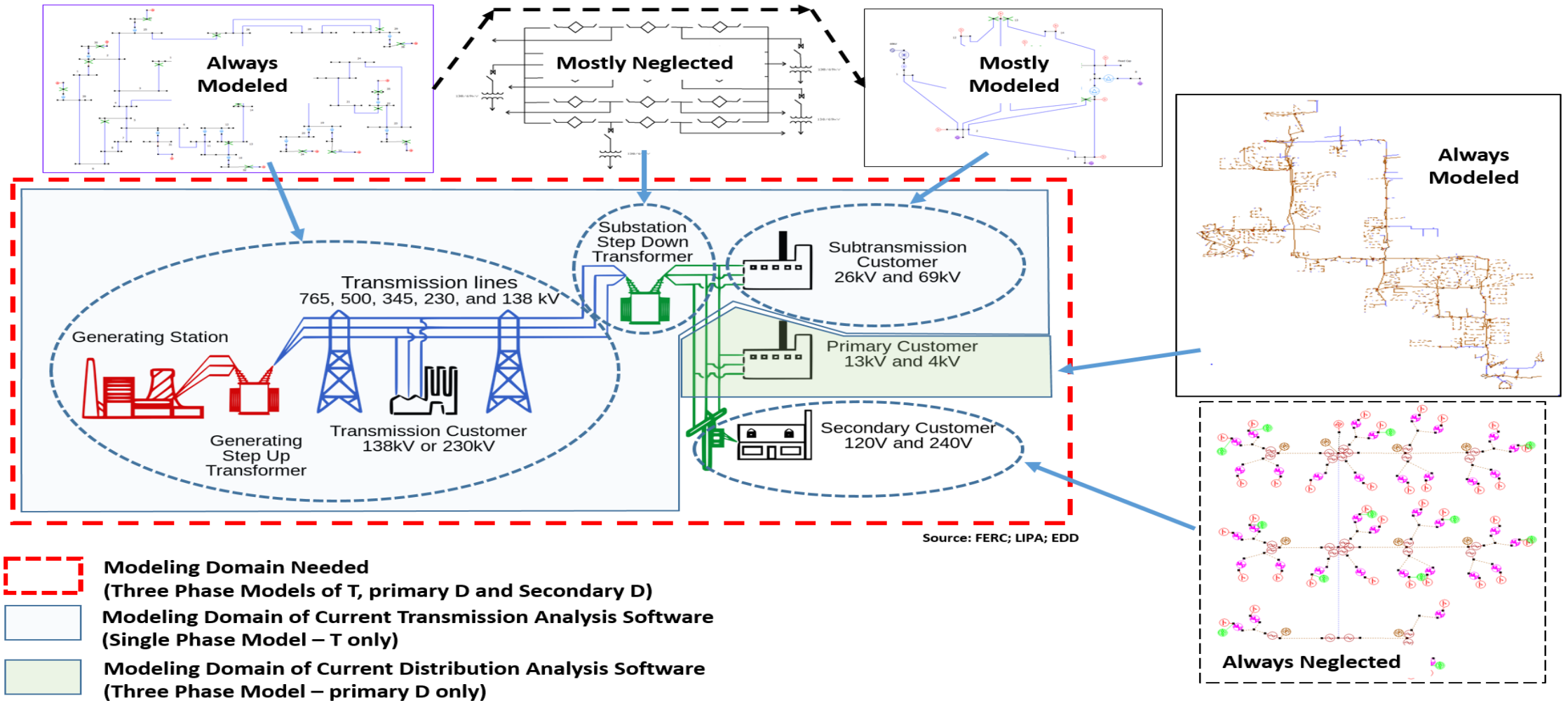
Kevin DeGroat
kdegroat@antaresgroupinc.com

Stephanie Hamilton
shamilton@bnl.gov

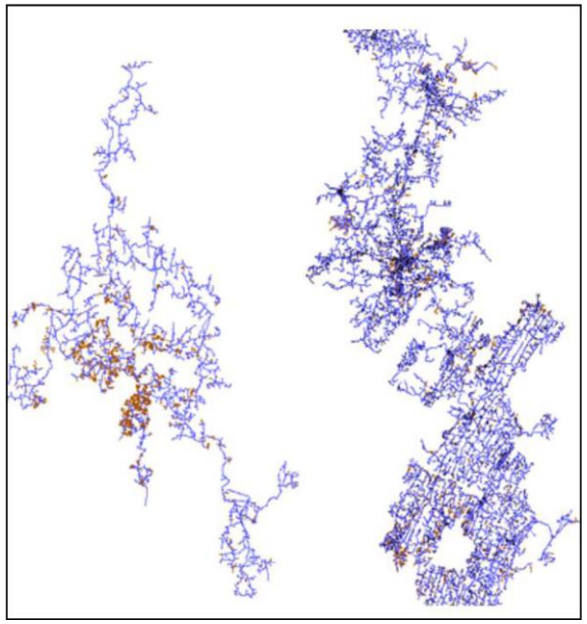
Robert Broadwater
dew@edd-us.com

edd
Modeling a Greener World

Modeling Today and the Future



NISC: Automated Analysis in the Cloud



Example ISMs

Automated Design in the Cloud: *Design for time varying load*

Where do ISMs come from?

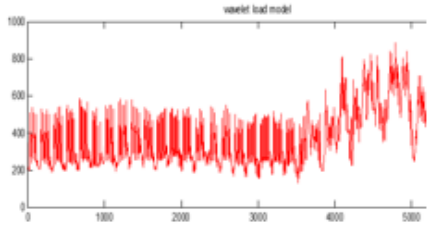
1-Substation models
2-Analysis models
3-GIS
4-Secondary data

} Models

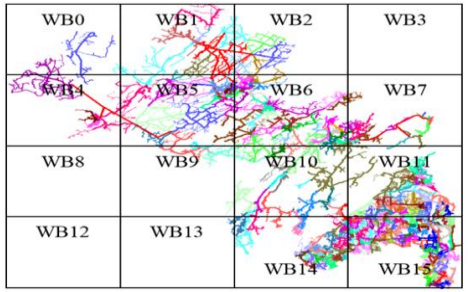
10-Field device settings
11-As-Is equipment list

} Real-time

5-Load - monthly, demand, AMI
6-SCADA/EMS
7-Generation
8-Outage data
9-NWS, Lightning, Radar-Weather: *corridor or area based statistics related to outages*



} Measurements



Move from "craftsman model" to "manufactured model"

Sample of DOE BNL Survey Results

BARRIERS

"The technical challenges do not appear to be as great as the interpersonal challenges, which include bringing together silos of responsibility, where the silos often do not speak the same language." **NISC**

"Very experienced personnel can be naysayers, and often an experience is needed to get their attention and change their perspective." **NISC**

"Getting processes in place to insure ISM stays accurate and in synch with field conditions." **ORU, CHGE, PHI**

BENEFITS

"Provides situational awareness for the whole system" **ORU**

"First line of defense in finding inaccurate meters" **ORU**

"Allows utility to become proactive in problem solutions" **CHGE**

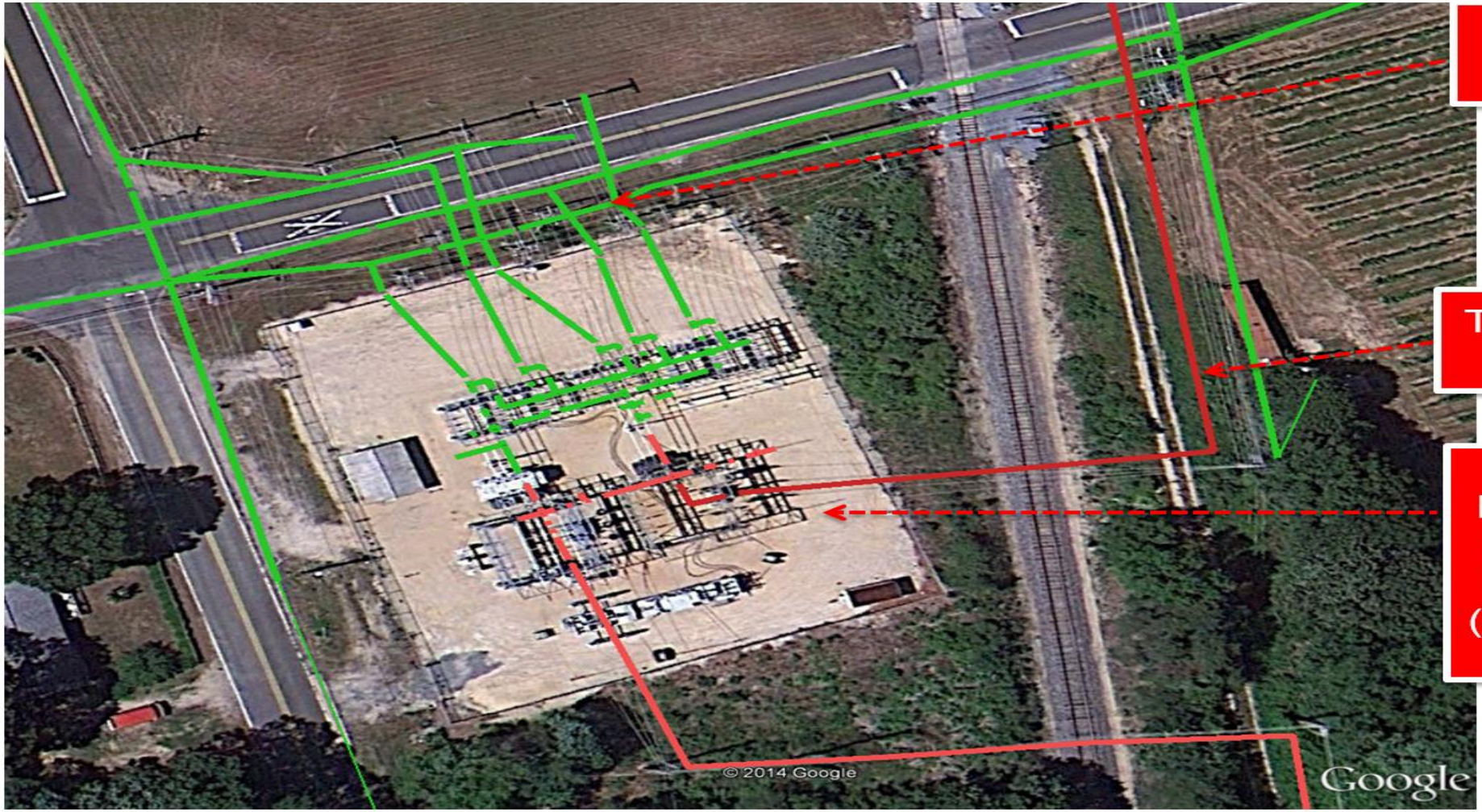
"Once an ISM is achieved model maintenance is more efficient" **NISC**

"Without an ISM the understanding of system behavior is limited to a few operators and engineers" ***SVP***

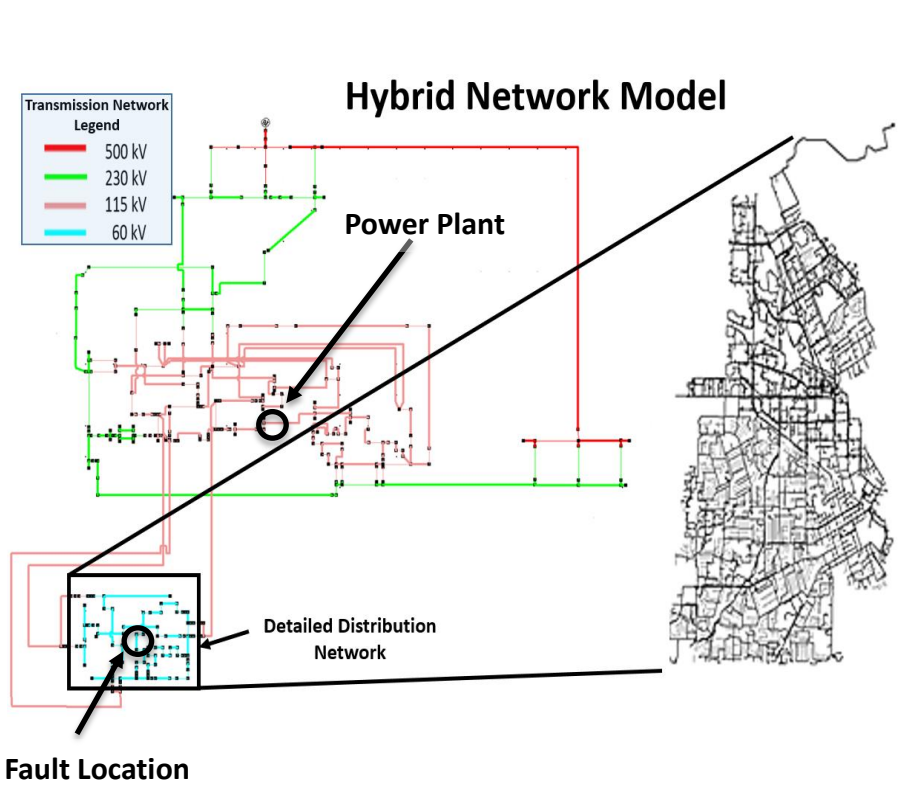
"With an ISM Automated analysis becomes possible" **PHI**

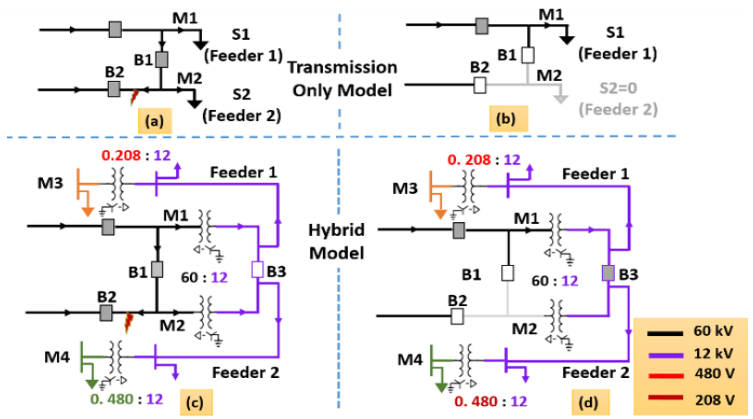
"As opposed to data analytics, ISM solutions cover the entire range of operations" **OSIsoft**

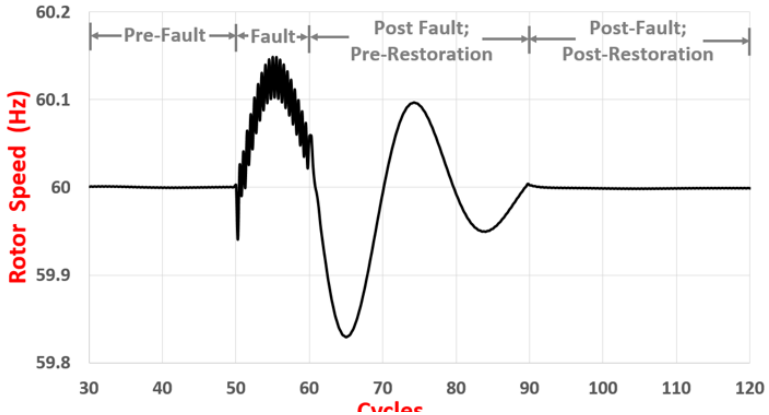
DEW T&D Over Google Earth

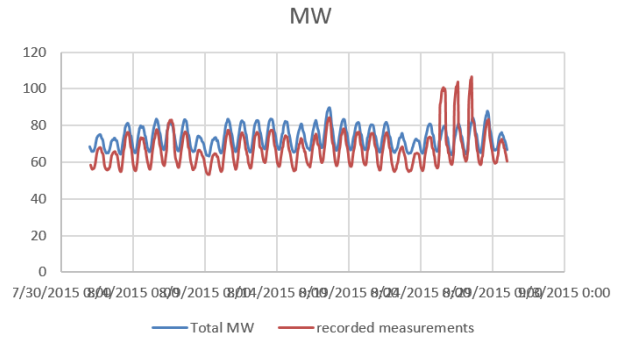


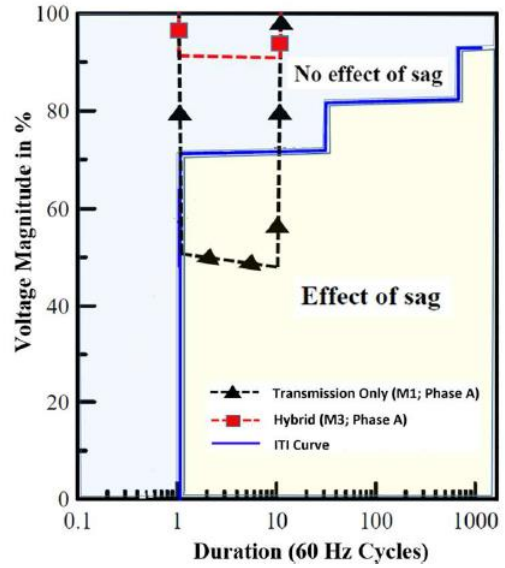
Is the distribution system just a load on the transmission bus?





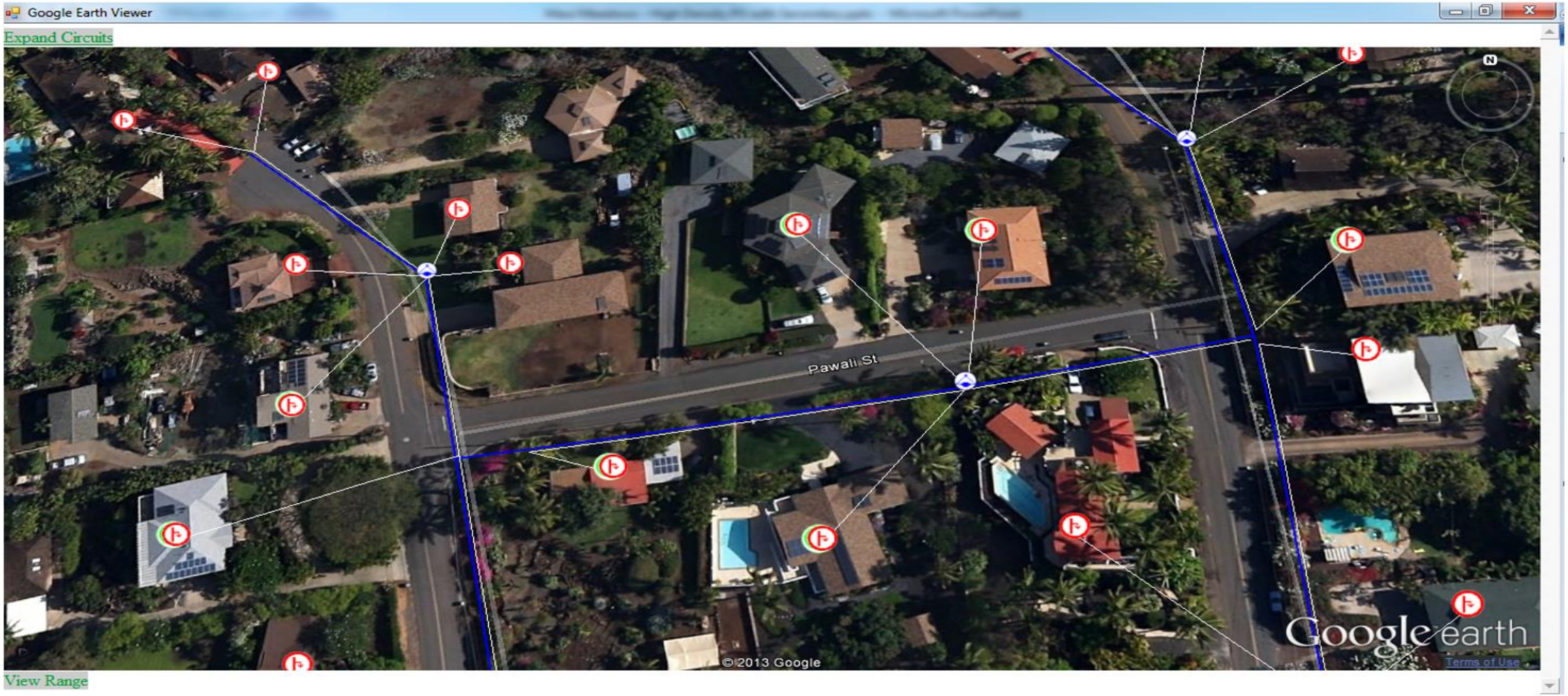




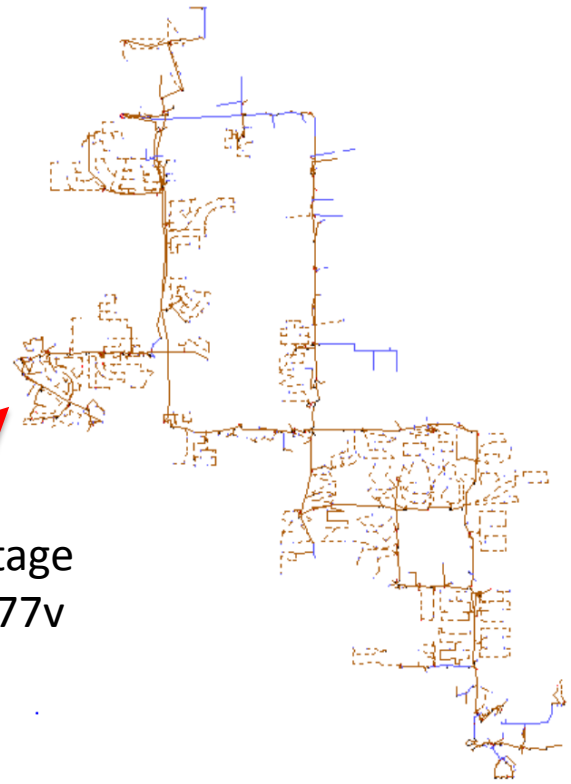


Fault applied at 50th cycle, cleared at 60th cycle, power restored at 90th cycle

DEW Over Google Earth Showing Secondary, Loads, and PV

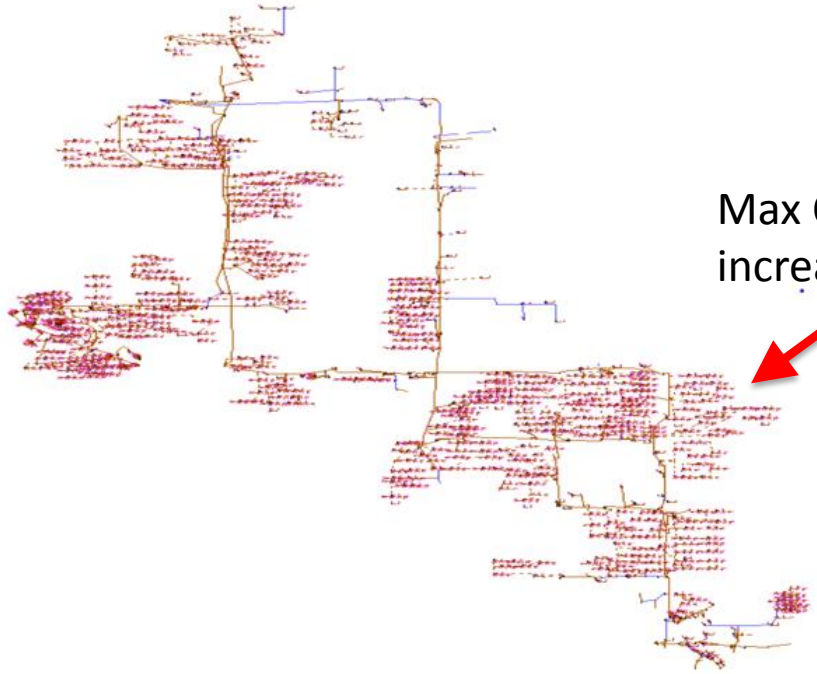


Is the secondary just a load on the distribution transformer bus?



Max QSS voltage increase = 0.77v

secondary circuit builder

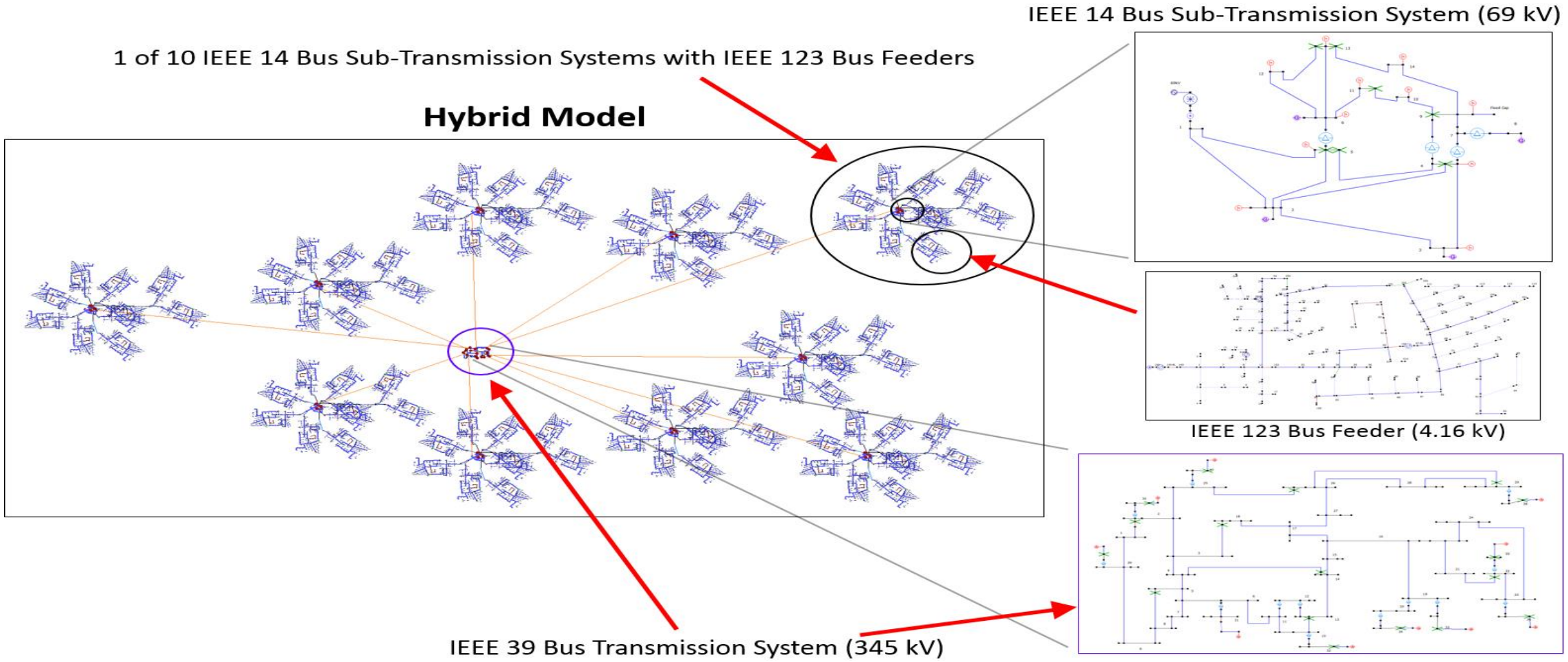


Max QSS voltage increase = 2.2v

3 feeders modeled to DT with one load bus,
3542 components,
633 load busses, 74 PV

same 3 feeders with detailed secondary models,
35619 components,
6912 load busses, 812 PV

ISGAN ISM Model from IEEE Standard Models



Summary: ISM Paradigm Changes

- Change to a community manufactured and maintained ISM
  - Reuse model across business functions
- Change to pushing algorithms to ISM where they collaborate
- Change to analysis for everyone
- Change to design for time varying conditions
- Change to Model-Centric Smart Grid decision making

Integrated System Models

Generic: ***Computer Science reusable, collaborative***

63,249 components

Holistic Solution ***Stephanie Hamilton***

Proactive Model ***Artie Kressner***

365,617 components

Living Model ***DOD***

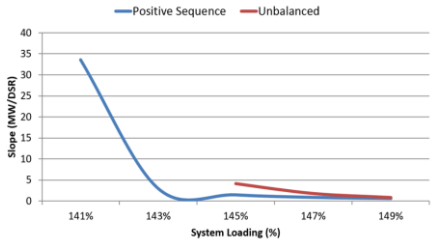
Manufactured Model ***Chuck Wells***

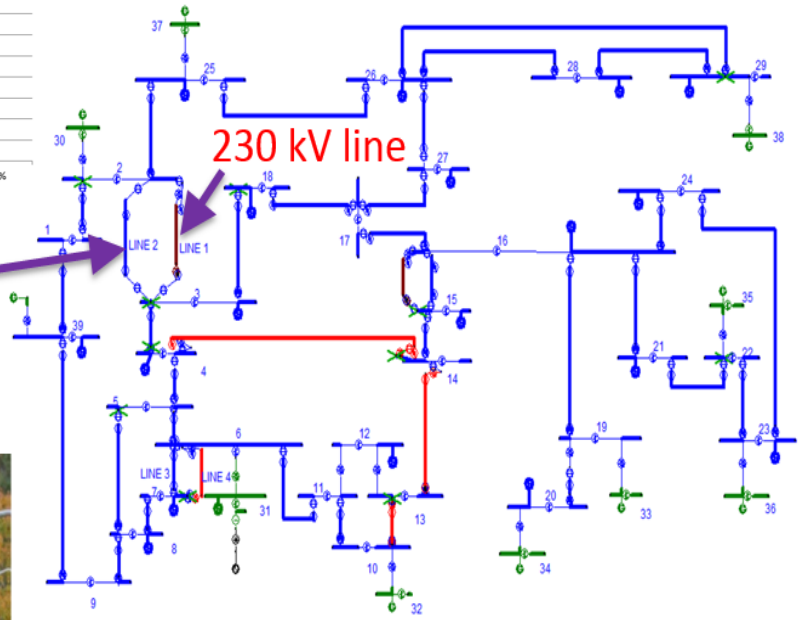
2,367,442 components

Hybrid Model ***ARPA-E***

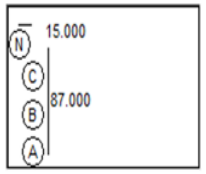
Big Analysis on Big Data

Are Transmission Systems Balanced?

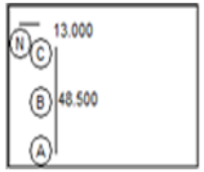




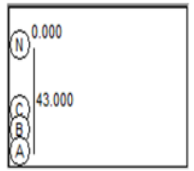
DSR



500 kV line spacing



345 kV line spacing



230 kV line spacing

Unbalanced transmission line construction